THE ELECTRICAL WORLD

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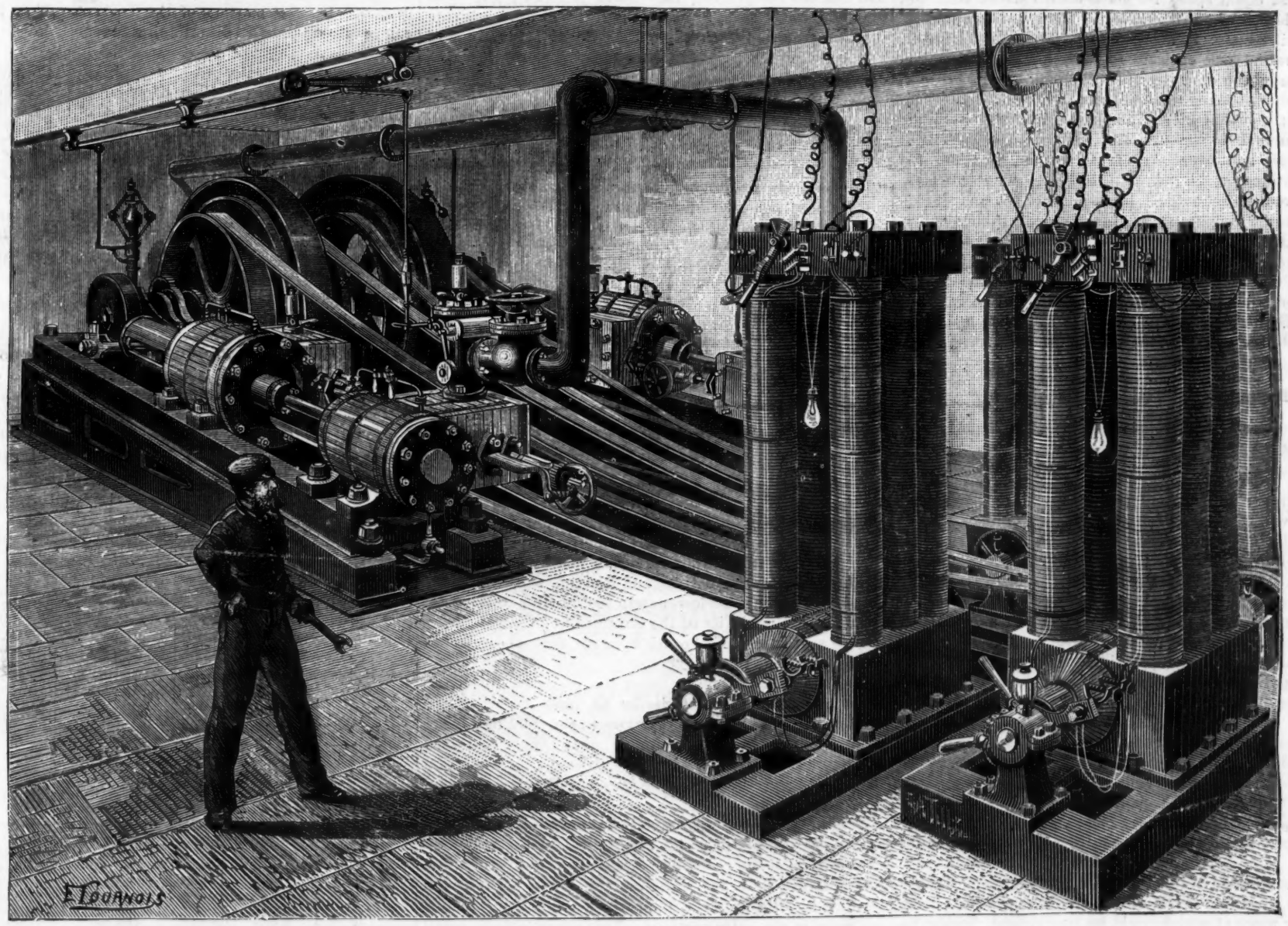
The Electric Light in Theatres.

From time to time we have called attention to the peculiar adaptability of the electric light, especially in incandescent systems, to theatres, as well for hygienic reasons as for spectacular purposes. Last September we treated the subject in an illustrated article, and on April 26 of the present year we published another illustrated description, that off the installation at the famous Theatre de la Scala at Milan. We have also devoted much of our editorial and news space to the matter, as we believe in this department, whether it be simply with the ingenious toys and trinkets of M. Trouvè or with the largest and costliest plants, that the electric light engineer is destined to achieve some of his most notable scientific and financial triumphs.

We now take pleasure, for the benefit of our numerous readers interested in the progress of electric lighting in any and all its applications, in presenting a fine view of the dynamo room of the Theatre Royal, Manchester, England. We are indebted for it to *La Lumière Electrique*, although the original drawings were made, we believe, for our esteemed contemporary, the *Mechanical World*, from which we derive information in regard to the details.

The spacious apartment in which the machines are located forms the basement of a large warehouse facing the Central Station, and about 100 yards from the theatre. The shunt-wound machines, shown in the foreground of the large accompanying engraving, are of the Edison type, and were made by Messrs. Mather and Platt, of Salford, for the Manchester and District Edison Electric Light Company, Limited, who are the contractors for the installation. There are four machines altogether, each of them being capable of generating current for 250 lamps of 16-candle power. Two of them only are in use at the same time, the total number of lamps required being about 500; but each pair being driven by a separate engine, and one engine and pair of machines being always kept running slowly, while the others are in full work, it is possible to substitute one pair for the other at all times in a few seconds, and without any one not specially watching for a fluctuation in the light detecting the fact. The current is conducted from the generating station to the theatre by means of two massive copper cables forming the lead and return. These are thoroughly insulated, and laid beneath the intervening street, the cables terminating on the stage at the proscenium entrance on the prompt side in a small room. The number of lamps in and about the theatre is 460, of which 200 are grouped in the sunlight, the remainder being distributed under the galleries, in the entrance hall, passages, saloons and other places. These being for the most part out of sight, do not interfere with the scenic effects, and they are therefore kept at their normal power during the whole of the time that the doors are open. The sunlight group of lamps is on a distinct circuit, in which is included a rheostat and a switch, so that by inserting resistance the glow of the whole group may be reduced to anything between a bright white and a dull red, or the current may be cut off altogether. During the last season a most brilliant and almost magical effect has been produced in the transformation scene of the pantomime at this theatre by the simple device of diverting the current from the sunlight group of lamps, where it is not then needed, to an equal number of lamps in the scene. By this means the success of what is undoubtedly one of the very best spectacles of this character ever witnessed in England, has been greatly enhanced. Simple as the fundamental idea is, the exigencies of the case have introduced difficulties which, however, were surmounted without a hitch from the commencement. We may indicate the general effect and at the same time some of the difficulties encountered by giving an account of the manner in which these 200 lamps have been distributed. In front, say, is a fairy with outspread glittering wings, the borders of which account for 20, while another 5 form a "glory" around her head. On either hand of the central fairy, but slightly behind, are two minor goddesses, having each a five-light tiara. Behind these is a semicircle of 30 lights, then two fairies, and behind these five others, each with five lamps for head-dress. These last five fairies are mounted upon revolving drums, to improve the effect and increase the difficulty. Above and beyond all the rest is an encompassing semicircle of 90 lamps. When the scene is just being completed, the spectacle, without the electric lights, the existence of which is unknown to the audience, is, even then, magnificent, but the effect when the sunlight is suddenly turned out and these 200 lamps as suddenly and simultaneously start into life, is startling and superb, and never fails to "bring down the house."



DYNAMO ROOM OF THE THEATRE ROYAL, MANCHESTER, ENGLAND.

The engines and boilers are of the design of, and were also erected by Messrs. Mather & Platt. Being, as they are in combination, the primary sources of the light, all should be done to obtain as nearly as is humanly possible absolute certainty of working. As has already been stated, the installation is one of 500 lights in duplicate. One engine is kept running slowly, while the other is developing its full power for the generation of current for 500 lights, so that in case of mishap to this engine the other can be set to work at the full speed in a few seconds and before the disabled engine has had time to pull up. The engines are run alternately on different nights to keep each in equal order.

The engines rest on inclined bed plates for the purpose of raising the flywheels of the belts clear of the floor. A description of one engine applies equally to the other.

Each engine is compound, with cylinders arranged tandem, the low-pressure cylinder being the nearest the crank. The cut-off in both cylinders can be regulated by moving the hand-wheels, which, by means of a worm and worm wheel, turn the expansion slide valve spindles, the screws on which adjust the expansion slides. The expansion valve spindles are worked by the same eccentric, but each may be revolved by the hand-wheels independently of the other to obtain for a given load the best grades of expansion in each cylinder. A variable cut-off for the low-pressure cylinder is, so far as we have observed, unusual for engines of this size, but it certainly provides the means of adjustment for working to the best advantage. The steam pressure is 120 lbs. per square inch. The high-pressure cylinder is 12 in. and the low-pressure 19 in. diameter, the stroke being 16 in. The engines run at 190 revolutions, giving the tolerably high rate of piston speed of 506 feet per minute. The pistons are packed with Messrs. Mather & Platt's patent elastic metallic piston rings. The piston-rods are of steel, and cottered together as shown in the low-pressure piston. The cross-head runs in bored guides. The flywheel is massive, and to it are secured in a very neat and mechanical way the two belt pulleys. The inside of the rim is turned, and the central ribfaced. The belt pulleys are without arms, being rims merely, which have flanges, turned and faced to fit the wheel to which they are bolted, the whole forming a substantial, true job.

The crank-shafts of the two engines are arranged closely end to end, exactly in line, and at the junction is a coupling which, when connected, enables the engines to be run together at equal speed for generating current sufficient for 1,000 lamps when this extent of lighting is required.

The boiler-house is a completely fire-proof chamber, bricked round and entirely separated from the engine-room save by the doorway and coal-hole, which are provided with cast-iron doors and frames. The original woodwork in the ceiling above boilers is protected by brick arching carried on wrought-iron girders. The boilers, of which there are three, are of the locomotive type, and work, as stated, at 120 lbs. The barrel is about 3 feet in diameter and 13 feet over all, including fire-box and smoke-box. There are copper tubes 1½ in. diameter in each boiler. As with the locomotive type, the exhaust is passed into the smoke-boxes through blast pipes on its way to the chimney, thereby improving the draught. The feed water is obtained from the town supply, and is passed into the tanks as required, by a tap governed by a ball-float, and thence into the boilers by an exhaust injector, thus utilizing some of the exhaust steam.

Magnetic Polarity and Neutrality.*

BY PROF. D. E. HUGHES, F.R.S.

(CONTINUED FROM PAGE 170.)

Internal Waves of Opposite Polarity.

All varieties of iron and steel have a high magnetic capacity while under the influence of its inducing force, such as the electro-magnetic coils, or strong permanent magnets, but this power in a great measure disappears on the cessation of the inducing influence, a return more or less perfect toward neutrality being the result; remaining magnetism is therefore of partial neutrality, more perfect in soft iron, where the molecules are in a greater state of freedom, than in comparatively rigid cast steel. Our so-called permanent magnets are simply the remains of a far higher magnetic state, and it is already in most cases half-way down on its road to neutrality.

It is absolutely necessary in a theory of magnetism that we should know the cause of neutrality, for it is really the starting point to appreciate how polarity becomes evident. In my previous researchs upon neutrality I used the induction balance, but in these I have employed more simple methods, which allow of repetition by the most simple means.

The first consists in forming compound bars of ordinary hoop iron, ¼ millim. thick, and 30 or more centims. long, twenty or more of which could be superposed, bound together by a fine copper wire, and forming a rod of any desired thickness. They were magnetised by drawing over magnets of various powers, and the degree of approach to neutrality observed by the amount of its remaining magnetism. Now, on carefully separating them, there were invariably found violent curves of opposing magnetism, previously held bound by the closed circuit of mutual attractions.

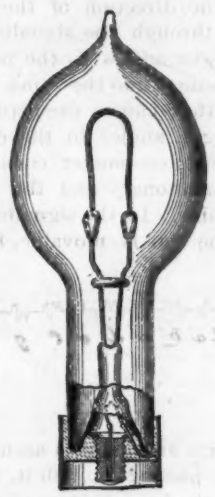
The second method consists in superposing the divided concentric tubes, already mentioned, bound together by a fine copper wire, and magnetising them in the electro-magnetic coils of the measuring balance. By this means we could observe the charge of full magnetic capacity under the influence of an electric current, the remaining magnetism upon its cessation, and after taking out the tubular core, separate it, and observe the polarity of its successive internal layers. This method is objectionable, as the slightest rubbing of one tubular surface against another may alter the true value. The electro-magnet method is, however, infinitely superior when observations are made on solid bars, or tubes of different degrees of thickness, to observe the influence of depth or thickness, in producing a perfect return to neutrality after cessation of the inducing effect of the coils.

* A paper read before the Royal Society, March 6, 1884.

The third method was a chemical one, somewhat similar to that employed by Jamin, except that as the object was to study the curves of neutrality, the bars were of annealed steel, highly magnetised in the coils, and afterwards reduced almost to a zero, by vibrating them, or beating them gently with a wooden mallet. We had by this means aided the molecules to follow their inclination, as they do in soft iron, for when a soft steel rod is in a state of vibration its molecules are comparatively free; but they rigidly retain the true curve of neutrality when not vibrated. We are thus enabled, by dissolving the exterior in various dilute acids, and by taking repeated observations, to draw graphically the waves of opposing polarities, which have produced external neutrality.

The curves obtained by the different methods are identical in form. The simplest and most accurate method is the first, as we can choose a hard variety of iron, such as ordinary hoop-iron, and by slight vibrations or blows with a mallet, allow the molecules sufficient freedom to form their curve before separating, and as the material is sufficiently rigid not to be influenced by mere contact, or even frictional drawings, we have on each strip a perfect record of its state, and can thus analyse the internal state of a neutral compound bar.

If we take a compound bar of the hoop-iron, and draw the lower side over the south pole of a magnet, it will be found nearly neutral, or if not sufficiently so, we can reduce it by slight blows with a mallet. Suppose the united bar gives still a remaining magnetism of 18° on the magnetic balance, on separating the components and observing the same ends we find the lowest (or the bar which had touched the magnet) 150° north polarity; the next may be slightly north or zero; the rest will have varying degrees of south polarity, from 60° to 10°, the total of which exactly balances the north polarity of 150 less 18°,



THE BERNSTEIN LAMP

which we already observed as the remaining magnetism.

If we do not wish to approach a perfect neutrality we should not vibrate the rods. In this case we may have 75° of remaining magnetism, and find on separating the strips that we have on lower strip 150° north and the total opposing south polarity of the interior but 75° south, leaving the remaining 75° of north polarity first observed on the compound bar unbalanced.

The mutual reactions between the magnetic molecules in a solid bar are precisely similar to those between two or more separate bars, the reactions in the solid bar being more pronounced and complete than those obtained through a separation of air; the greater the separation the less the re-action, but in no case will the law of neutrality be changed.

In homogeneous iron or steel, we have a well-defined curve, the distance of which can be calculated from observation upon the remaining magnetism, but if the interior is harder than the exterior, the inner portion will from its rigidity preserve its previous magnetism, reversing entirely the outer portions. This occurs also in small electro-magnets.

I have been enabled to prove this by the chemical method, employing either dilute sulphuric acid, acidulated bichromate of potass, or dilute nitric acid (1 pint acid to 5 water), the latter being far more rapid and equal in its action. The following experiment will show rapidly the influence of the outside reversal polarity. Let us take a soft steel wire 1 millim. diameter, 10 centims. long. Magnetise it in a coil, or by drawing over a strong permanent magnet, so that it has perhaps a remaining magnetism of 200°. If we vibrate this rod or give several blows from a mallet, we can reduce this to 25°; we have now almost perfect neutrality, having only a remaining magnetism of 25°, which remains a constant for years if not re-magnetised. Place this rod in dilute nitric acid, and in 15 minutes it will rise to 50°, or double its previous value, in one hour to 75°, and two or three hours to 100°, or four times its previous force; the increased force of 75° has been rendered evident by dissolving an equal opposing polarity of 75°, so that we have already found 75+75+25= 175°, or 87 per cent. of its highest force. This is so easily repeated with soft steels of all sizes and dimensions, that there can no longer be any doubt as to the existence of the outside reversed polarity. The experiment is more difficult to repeat with soft iron, as from the freedom of its molecules a fresh outside reversed curve if formed anew as the exterior is dissolved, the balancing curves reproducing themselves until we have almost entirely dissolved the iron; still with care, and iron not too soft, we can render evident all the neutral curves seen in steel.*

(*To be continued.*)

The Boston or Bernstein Lamp.

We have had many applications of late for particulars in regard to the Bernstein lamp. The subjoined, with cut, appeared in the London *Electrician* of May 31, and we reproduce both for the benefit of inquiring readers:

When gas superseded the candle and the oil lamp the economy realized consisted not so much in the cheapness of the light-giving material as in the concentration of light. One gas burner gave the light of 12-16 candles. It seems strange that this principle is so little mentioned with reference to incandescent electric lighting. The ordinary Edison or Swan lamp does not give more light than an ordinary gas burner, and hence the greater expense of electric lighting. We all know that electric lighting is still in "*statu experimentis*," but all the adverse criticism can be traced to one common source, namely, to the question of expense. Any improvement in this direction—any lamp which considerably diminishes the expense, if it also meets other requirements—must therefore be hailed with satisfaction, and such an improvement, it is claimed, was shown at the Vienna Electrical Exhibition of last autumn. Most of the incandescent lamps in use up to the present have a fine carbon thread of high resistance, which is brought to incandescence by the passage of the current. They have a comparatively small illuminating surface, and on an average gave a light of 16-20 candles.

The Boston lamp, invented by Mr. Alex. Bernstein, of Boston, Mass., gives a light of from 50-60 candles. A hollow carbon cylinder taking the place of the fine thread, and a larger illuminating surface, but with lower resistance, is hereby obtained. The external appearance of the lamp differs little from that of other lamps, only, as will be seen from the diagram, the carbon cylinder is not directly connected to the platinum wires, but by means of a special cement to two copper wires, which are soldered to the two ends of the platinum wires. The wires are kept in position by being fused into two pieces of enamel; a brass ring and a centre screw, each connected to one of the wires, are firmly attached by plaster of Paris to the lower extremity of the lamp. The brass ring and the central screw are fitted to a specially-constructed lamp holder.

The characteristic part of the lamp, the essence of the Bernstein patent, is made by carbonizing a narrow and hollow ribbon of white silk.

The following are the measurements taken by the Scientific Commission of the Vienna Electrical Exhibition, under the presidency of Professor Dr. Kittler:—

LAMP NO. 2 (60 CANDLES NORMAL).

Experiment.	Ampères.	Volts.	Candles normal.	Volt-Ampères.
1	3·977	21·588	10·94	85·86
2	4·120	22·286	13·94	91·82
3	4·294	23·120	17·80	99·28
4	4·450	23·880	22·02	106·27
5	4·869	25·894	35·96	126·07
6	5·391	28·387	60·71	151·03
7	5·825	30·445	91·87	177·34
8	6·129	31·776	113·03	194·74
9	6·464	31·372	142·18	202·79
10	6·854	33·018	195·44	226·31

LAMP NO. 4 (90 CANDLES NORMAL).

Experiment.	Ampères.	Volts.	Candles normal.	Volt-Ampères.
1	6·582	27·776	27·689	182·82
2	6·988	29·291	37·897	204·68
3	7·694	31·580	56·779	242·99
4	8·360	33·305	88·600	282·61
5	8·540	34·334	95·576	293·20
6	9·251	36·523	138·96	337·87
7	9·286	36·523	150·08	339·15
8	9·657	37·673	180·20	363·81
9	10·701	41·200	287·47	440·88
10	11·226	43·349	344·42	486·64
11	11·831	45·773	467·00	541·60
12	"	"	616·52 burned through	"

Comparing the efficiency of the Bernstein lamp with that of the other incandescent lamps we get the following:

Name of lamp.	Candles per H. P.
Lane-Fox	118
Maxim	152
Edison	163
Swan	190
Bernstein	294

MUTUAL LIFE BUILDING, NEW YORK.—The fine Sawyer-Man installation in this building will be in running order very shortly. The company have offices on the sixth floor. They will have a plant for 1,700 twenty-candle power lamps. The wiring throughout the building has been done by F. E. Kinsman & Co., 145 Broadway, and the firm have received high compliments from the fire underwriters on the creditable manner in which the work has been done.

* Thin flat steel, such as clock-springs, saw-blades, or ribbon steel, well annealed, are most suitable for this experiment. They may be of any width or length; the thickness may vary between ¼ and ¾ millim. I have found that strips of ⅛ millim. thick give the highest result.

Ocean Telegraphy.

BY WM. MAVER, JR.

PART III.

Perhaps the following illustration will help to make clear the manner in which induction causes retardation on cables.

Let us suppose that instead of the cable we have a canal along the sides of which at short intervals are placed basins, and at the other end of which we have a large waterwheel. We know that if we let in a supply of water at one end of the canal, the water will not fill it along its entire length until it has first filled the basins. It is true that a small portion of the water might reach the distant end, but it would be powerless to turn the large waterwheel there. Again, when we should cut off the supply of water, the water stored up in the basins along the sides of the canal would then also run out and keep

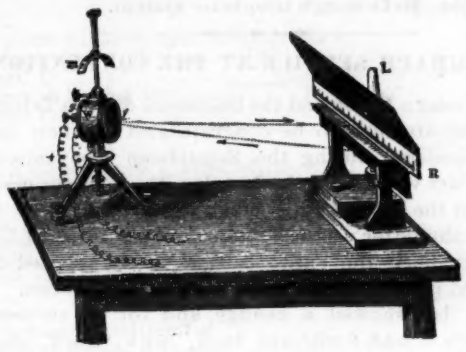


FIG. 5.

the large wheel in motion longer than would have been the case had there been no basins along the canal.

Induction has an effect on a cable somewhat analogous to that of the basins along the canal. The basins increase the water-holding capacity of the canal; induction increases the electro-static capacity or electricity-holding capacity of the cable. It has been ascertained that the electro-static capacity of one mile of underground cable is equal to that 23 miles of overland wire of similar size.

Now if instead of the large wheel at one end of the canal, we should place a very much smaller and more sensitive wheel, it is plain that we could make it revolve with a much smaller quantity of water, especially if we should arrange to spout out the water with great force, and it would not be necessary to wait until the canal was quite or nearly full.

On the other hand, also, the wheel would come to a stop much sooner when we should cut off the smaller supply of water. The latter plan is analogous to the method adopted to operate all long submarine cables, viz., a small but forceful battery is used at the sending end and an exceedingly delicate and sensitive instrument is employed at the receiving end.

On the Atlantic cables there are two forms of receiving instruments used, both of which are the invention of Sir

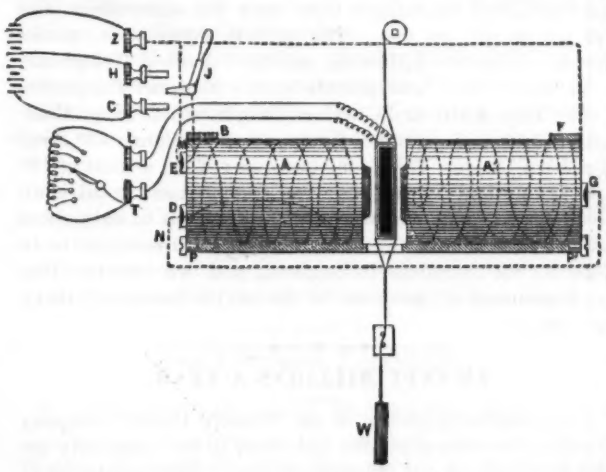


FIG. 6.

Wm. Thomson, namely: The Thomson mirror galvanometer and Thomson's siphon recorder.

The Thomson mirror galvanometer consists of a coil of many convolutions of fine wire, having a resistance of about 2,000 ohms. In the centre of this coil is placed a very small magnetic needle about one quarter of an inch long. This needle is fastened to the back of a circular mirror about the size of a five-cent piece, and the needle and mirror are suspended within the coil by a a single thread of very fine silk.

This apparatus, coil, mirror and needle, is inclosed in the circular box *W*, Fig. 5. This box is made air-tight to prevent currents of air from moving the delicately suspended needle. An adjustable permanent magnet, *M*, is held on a vertical shaft, as seen in the figure, the purpose of which magnet is to hold, by its directive force, the magnetic needle parallel to the length of the coil.

The terminals of the coil within the box *W* are connected with wires leading to the cable. The slightest current passing through the coil overcomes the directive force of the permanent magnet and deflects the needle to the right or left, according to the direction of the current.

A beam of light from the lamp *L* is allowed to pass through a slit in the scale, *R*, and this beam, by means of a lens, *l*, is concentrated upon the little mirror, which reflects the beam back upon the scale It is thus evident that when the mirror is moved, the reflected beam will also be caused to move, and that to a greatly magnified extent over the motion of the needle and mirror. In this way the operator is enabled to read with ease the slightest movements of the galvanometer needle.

A motion of the beam of light on the scale to the right signifies a dot (.). A motion to the left a dash (—). It is not necessary that the receiving clerk should sit in a darkened room. If the scale be placed in a shadow it is sufficient.

When this method of receiving is employed, it requires one operator to translate the signals and another to transcribe the message at the dictation of the former.

It may be said that the action of the Thomson siphon recorder is almost the opposite of the former, as we shall see.

The recorder consists also of a coil of many convolutions of fine wire, but instead of having, like the reflecting galvanometer, a magnetic needle within its centre, the coil itself is placed between the poles of very strong magnets, as seen in Fig. 6. These magnets furnish an intense magnetic field, and to add to the sensitiveness of the coil, a core of soft iron is placed in the centre of it.

The coil of wire, or signaling coil, as it is called, is suspended as shown in Fig. 6, by a very fine thread. It is held in that position by the weight *W*, which is suspended by silk fibre from the lower bend of the coil; this weight does not weigh an ounce.

When a current, or rather an impulse, of electricity, is sent through the galvanometer coil, the needle tends to place itself at right angles to the length of the coil, or in other words, to the direction of the current. When an impulse is sent through the signaling coil, it tends to place itself at right angles to the magnetic poles. The coil does so in obedience to the same law of electro-magnetic induction that causes the needle of the galvanometer to turn at right angles to the direction of the current through the galvanometer coils. In the galvanometer the coil is stationary and the needle, that is, the magnet, is movable. In the signaling coil the magnets are fixed and the coil is movable, hence the magnetic lines of force which are induced around the copper wire when a current is passing through it, tend to place themselves parallel to the lines of force of the permanent magnets and in doing so carry, as it were, the coil with them, just as the "lines of force" of the magnetic needle within a coil endeavor to place themselves parallel to the lines of force induced around the latter coil when a current passes through it, and thus also carry the needle with them.

This naturally gives the coil a vertical semi-rotary motion when currents of different polarity are being sent.

To one of the upper sides of the coil another fibre is attached and the fibre is connected by means of pulleys to a small glass siphon in the manner shown in Fig. 7.

The siphon *t* in the figure is held in the desired position by proper apparatus. One end of this siphon dips into an ink well, *K*, Fig. 8, and the other end is placed directly over a strip of paper tape *c*, in the same figure.

The connections between the coil and the siphon are so arranged that when the coil rotates, the siphon moves backward or forward across the paper, and as it moves, it spurts out small drops of ink on the paper. The paper tape is, of course, kept moving, as in the ordinary Morse recorder, so that a succession of up and down lines are marked on the paper.

When at rest, the siphon is so placed, as regards the paper, that if the latter were kept moving, a continuous line would be traced on the centre of the paper. This centre is called the zero line. A mark above this line stands for a dot, one below for a dash.

A specimen of the continental alphabet, as received by the siphon recorder, is shown in Fig. 9.

It should be stated that ordinarily the characters are not nearly so plainly recorded as shown in this figure, as even with the improved apparatus used, retardation and prolongation still take place to a certain extent, and thus the siphon does not, when a succession of dots or dashes are sent, altogether come to zero between each dot or dash, hence the letter H, for instance, would probably be recorded by four indistinct wave-like marks above the zero line. The signals are, however, easily read by experts.

The siphon itself is of very delicate construction, not being much thicker than a hair. Its actual size and appearance may be seen in Fig. 10.

Owing to the small size of the tube of the siphon, a device was necessary to insure a flow of ink through it. This was accomplished by means of an electro-static induction machine called a mouse mill, which is used to electrify the ink with one electricity and the paper with another, so that the mutual attraction of the negative and positive electricity produces a steady succession of drops of ink in response to the pulsations produced by the mouse mill. The same machine is also used to move the paper past the point of the siphon.

Besides these there are other methods employed on some cables for receiving signals. They are, however, only modifications of the foregoing. For instance, instead of the graduated scale seen in Fig. 5, another mirror is so placed that it re-reflects the beam of light or "spot" as it is called, upon the operator's desk or blanks. He thus can transcribe signals without looking up from his desk.

(TO BE CONTINUED.)

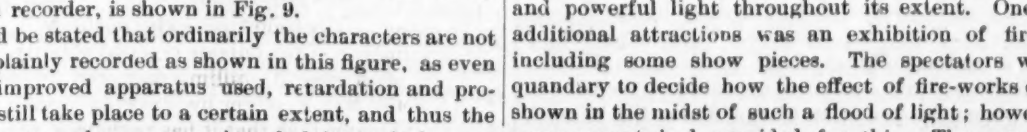


FIG. 9.

Lighting a Large Race Track.

A correspondent says: The management of the Exposition Park, Allegheny, Pa., has, during the past week, given

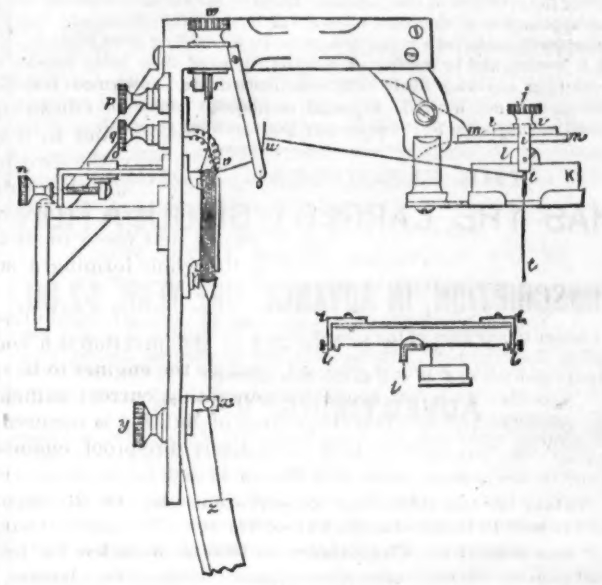
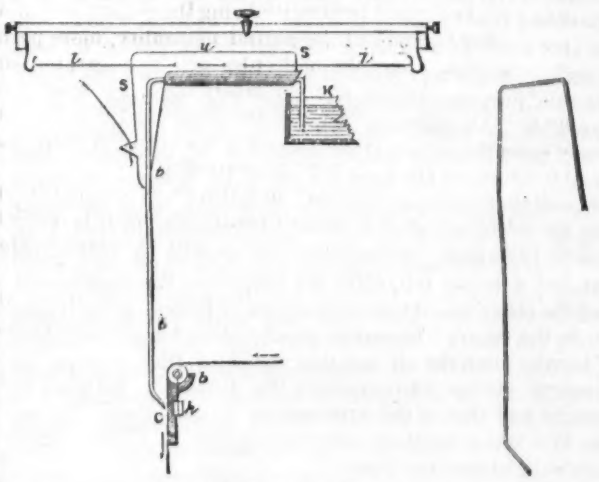


FIG. 7.

a novel open-air exhibition, including races, &c., over a full half-mile course, by electric light.

Under the supervision of Superintendent Duncan, the Allegheny County Light Company so placed and manipulated the lights as to show completely all parts of the track and from every portion of the large park with such distinctness as to enable the spectators, from their seats on the grand stand, to distinguish every motion of horses and riders, and to recognize the colors of the contestants.

Four masts were used in the interior of the track, and three lights were suspended from each mast. In addition to these a series of lamps were arranged along the inner circle. The result of this arrangement was to entirely



FIGS. 8 AND 10.

avoid shadows on the race-course, and to secure a uniform and powerful light throughout its extent. One of the additional attractions was an exhibition of fire-works including some show pieces. The spectators were in a quandary to decide how the effect of fire-works could be shown in the midst of such a flood of light; however, the management had provided for this. The moment the pieces were prepared, the lights in the interior disappeared and only a mellow flood from the rear of the spectators was visible, thus rendering the darkness of the track the more perceptible, and giving the fire-works a grand effect, much to the gratification of spectators and management; and yet the sparks from the exploded fire-works had not descended when the circle was again flooded with light as if by magic.

We believe this is the first instance of the successful lighting of so large an open air space for such purposes. It will probably provide a new field for the electric light.

YARMOUTH, N. S. has a telephone company, and the capital has just been increased to $15,000.

THE
ELECTRICAL WORLD,
PUBLISHED WEEKLY.

W. J. JOHNSTON, - Editor and Publisher.

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NEW YORK, JUNE 14, 1884.

BURNABY ON BALLOONING.

Col. Fred. Burnaby, of "Ride to Khiva" fame, has published in the last number of the English *Fortnightly Review* a very interesting article on the possibilities of ballooning. It is creating some comment here and abroad, chiefly from the fact that he expresses a depreciatory opinion of ballooning, and thinks that we shall not learn to navigate the air so long as we are satisfied with trying only that means. The gist of his article lies in the following passage:

"So far as the solution of the problem how to navigate the air is concerned, we believe that balloons have done more harm than good. The attention of inventors has been diverted from what is probably the only feasible way to obtain the desired end—namely, the construction of a machine, itself heavier than the atmosphere, which will be able to strike a blow on the air in excess of its own weight. Machinery worked by steam is much too heavy for this purpose; electricity some day, perhaps, will be available. An engineer who has made electricity his study recently informed an assembly of gentlemen that in the course of the next ten years he believes it would be possible to compass enough electricity in a substance the size of an egg shell to drive an express train from London to Liverpool. Science has not arrived at this point yet, but who can tell, after the telephone, the phonograph and the other marvelous discoveries of Edison, what it may do in the future? Inventors should never forget that a bird is heavier than the air and that the bird flies because its strength enables it to overcome the difference between its weight and that of the atmosphere it displaces. To put the case into a nutshell, aerial navigation is a mere question of lightness and force."

In the course of his article, Col. Burnaby refers to the exploits of M. Tissandier in ballooning some years ago, and it is therefore not a little remarkable that he should have passed over in silence what was done by the Tissandier brothers at Paris last October. Their experiments then made so successfully are most pertinent to the subject. A full description of them appeared at the time in *La Nature*, from the pen of M. Gaston Tissandier himself, and it showed the extent to which Col. Burnaby's idea has been realized up to the present time. Their controllable electric balloon consisted of the large air balloon, like a pointed egg, the gas apparatus to inflate it, and the electric motor to secure freedom of motion by means of a screw. It will be seen that they stuck to the old balloon which Col. Burnaby considers so harmful. Their "electricity in a substance the size of an egg shell" consisted of a Siemens dynamo-electric motor, weighing fifty-four kilograms, and a bichromate of potassium battery of four ebonite troughs, with six compartments each. The pile, zincs, carbons and liquid, weighed one hundred and eighty kilograms. With all the elements employed, a motion of the balloon horizontally was noticeable, and the aerial navigators were able to turn to right or left from the line of the wind. Unfortunately, when the brothers tried on the second day to renew the ascent, they found that owing to the coldness of the night, the bichromate of potassium in their ebonite tanks had crystallized, and the battery, though by no means exhausted, was incapable of action. The results are summed up by M. Tissandier in these conclusions: 1, that electricity furnishes a balloon with the most convenient power, the management of which in the car is remarkably easy; 2, when their screw, 2.8 metres in diameter, made 180 revolutions per minute, they were able to keep head to a wind moving 3 metres per second, and when proceeding with the current, to deviate from the line of the wind with great ease; 3, the mode of suspending a car from an elongated balloon by means of bands running obliquely and supported by flexible side-shafts insures the stability required for the battery, motor, and other parts. There appears to be no good reason why a more powerful motor should not be used.

It is interesting to note here what Mr. Edison has to say on this subject of aerial navigation, for there are few men who combine hard-headed common sense, a facile inventiveness and a lively imagination so remarkably. When asked a plump question on this point recently, he said that electricity would be available when we can get five or six times more power per hour of weight than is now obtained from the best form of small engines. "Having lightness with power, we should only need enough balloon for actual lifting power, and we would attain a very high velocity. You could hold a ten-horse power motor out in your hand, and once in the air, with five pounds of coal, could the consumption be direct, the little jigger could go anywhere. Nobody would want to ascend to great heights where the air's resistance to the propeller would decrease, but skim along over the trees and houses like a bird above the water. The rudders could all be worked and your ballastless balloon could be raised or lowered, turning to the right or left, by the motor itself, and a boy could do all the work. Such an arrangement could scarcely do for heavy freight, but it could carry passengers and mail matter and express parcels, and move readily at 80 to 100 miles an hour. If we can solve the power question we can do anything."

THE MUTCHLER BILL.

We hope that amid all the political excitement and with the prospect of an adjournment on the 30th inst., Congress will not forget the bill introduced in the House of Representatives last January by Mr. Mutchler, providing for the appointment of a Government Commission to conduct a national conference of electricians at the Philadelphia Electrical Exhibition next September, and appropriating the money for the expenses of that Commission. The bill has already been unanimously agreed to by the House Committee on Commerce, but we suppose that, as history repeats itself, it may, like the bill for Prof. Morse's experimental line, be passed in the last expiring hours of Congress. This, however, should not be the case, for if favorable action be taken quickly the President will be better able, by reason of having more time for deliberation, to select the very best representative electricians to serve on the Commission. We have referred to this subject before and have urged prompt action, for it is a subject worthy of support by the people at large. The formation of the American Institute of Electrical Engineers, now well under way, shows the drift upward among the busy army of electrical workers. The splendid results of a kindred society in England, and the wide-spreading uses to which electricity is put the world over, indicate that it is not wise to delay longer in forming a cis-Atlantic organization, which by more frequent intercourse and more thorough order and discipline among our electricians shall lead to better results than can be attained by individual workers. The London *Times*, as we are informed by cable, has just been expressing—they call it "thundering," we believe—its Jovian wonder at the astonishing development of industrial education in America, and has frankly admitted: "The Americans are far ahead of us in institutions for giving their sons and daughters the practical training which fits them for industrial pursuits." The *Thunderer* is right, and electricity has gained much in America, as the telephone and the quadruplex attest. But this Benjamin of the great family of scientific industries needs to be helped yet. An appropriation for the proposed Electrical Congress at Philadelphia will be no less productive of magnificent results than was the original appropriation granted to S. F. B. Morse.

SURVIVAL OF THE FIGHTEST.

Last week we said that another telegraphic deal was in preparation, and stated that the Postal Company were negotiating for the control of the lines of the Bankers and Merchants' Company. This week we publish the details of the scheme under which the two companies will now operate together. Some such combination was inevitable, as a result of the financial troubles in which Mr. Dimock became involved during the Wall street panic, and no one who has followed closely the growth of the opposition systems will feel surprised at the turn of affairs.

People want to know, and naturally, where the process of combination will stop. This union of the Postal with the Bankers and Merchants', the Postal being "on top," is regarded as significant. Mr. Mackay is not very far removed in interests from Mr. James Gordon Bennett, and both are close to the Garrett family. Hence it is thought that a grand consolidation will take place sooner or later under the lead of the Baltimore & Ohio Company, when the competition will become very hot, perhaps too hot for Mr. Gould. On the other hand, the Postal may prefer to stand alone, now that it has, all told, ready for use or in progress of construction 12,000 miles of pole line and 76,000 miles of wire, as well as a brand new ocean cable. It was said, too, last week by a director of the Postal Company, that the Baltimore & Ohio Company had been seeking to get possession of the Dimock property, but had practically been "euchred" by the Postal Company. A notable feature in the new arrangement is that the Postal Company are placed in a position to develop the admirable "stock ticker" inventions of Mr. Stephen D. Field, as worked by the Commercial Telegram Company. We shall watch with interest to see what the new allies will do with the McDonough telephone system.

TELEGRAPH SERVICE AT THE CONVENTION.

The Western Union and the Baltimore & Ohio Telegraph Companies are both to be congratulated on their grand service rendered during the Republican Convention at Chicago last week. On the first day, the younger concern rather got the better of the older one, and we were wondering if the latter was still the grand old Western Union that telegraphed the entire edition of the revised New Testament promptly to Chicago on a moment's notice. But the next day showed a change, and for the succeeding three days it was "nip and tuck," with "tuck" slightly ahead, according to report. The service was admirable, and while we push the stone over the green grave of the proposed Government monopoly, we have ample time to reflect that there is, as thus shown, nothing like private enterprise when stimulated by the old adage that competition is the life of trade. The Western Union was caught napping—the same old nap—on the opening day of the Convention; but, under the prodding of its vigorous young rival, it rose to the emergency and thereafterwards matched it squarely at every point. Under private enterprise no competing company can afford to take its quiet siesta—it must be up and doing—and we look for young men like President Bates and General Superintendent Zeublin and their assistants to teach the older men how to do.

THE RARITY OF TELEPHONES IN ENGLAND.

A couple of weeks ago we commented on some figures taken from the *Postal, Telegraphic and Telephonic Gazette*, relating to the use of the telephone in Germany under government control. The showing was beggarly in the extreme. The same journal has now printed a very interesting enumeration of the telephone subscribers in England. It appears, as we have more than once said, that in England the interference of government authorities has proved a sore hindrance to the commercial progress of the telephone there. We learn from this statement that the Post-Office Exchanges have only 783 subscribers, and 982 telephones in use. The private companies, under license, make the following exhibit: United Telephone, 3,787 subscribers and private wires; National Telephone, 4,069; Lancashire and Cheshire Telephone Exchange Company, 3,698; Telephone Company of Ireland, 732, and Northern District Telephone Company, 260; a total of 12,546. Including with these the 982, a grand total is arrived at of 13,528, which is said to work out to only about 0.8 per 1,000 inhabitants. Evidently much remains to be done for the telephone in England, and we observe that our contemporary proposes to discuss the causes of its restricted use.

TWENTY MILLIONS A YEAR.

The remarkable ability of the Western Union Company to earn a revenue is plainly exhibited in the quarterly report published in our columns to-day. The regular dividend is to be paid, as we expected, and yet a surplus of $200,000 is shown on the revenues for the period. The gross earnings for the fiscal year closed by the report reach the magnificent sum of $20,000,900. Reference is made in the report to the cost of the strike. It is a great pity that a company doing so large a business could not have made things more pleasant for its operators, who are to be credited with much of its growth and prosperity. A list of the able men who have left the service of the company during the fiscal year would detract somewhat from the brilliancy of the annual report, if the two were placed in juxtaposition.

THE WINGS OF RICHES.

A favorite subject of discussion with financial writers lately has been Mr. Jay Gould. They have all been figuring very diligently on his losses during the late convulsion, and some of them have arrived at the most astounding results, with which, probably, nobody would be more surprised and amused than Mr. Gould. One list of losses puts his speculative loss on Western Union at $13,200,000 and on American Cable at $232,000, because in 1881 he held 300,000 shares of the former at 93, whereas it went down

last month to 49, while the latter, of which he had 8,000 shares, went from 78 to 49 also. This is easy arithmetic, and the best comment on it is that both stocks are up again several points, wiping out much of this imaginary loss. Besides, the figures do not take into account Mr. Gould's stock transactions. It would be like him to make something on each turn of the market during those exciting days, buying on the decline and selling out on the rise. Mr. Gould's dividend income, too, would still be the same on those stocks, although, of course, he could borrow less on them.

Western Union Report.

The official statement of the condition of Western Union for the quarter ended March 31 last is as follows:

Surplus January 1, 1884, as per last quarterly report		$3,970,931.78
Net revenues, quarter ending March 31, 1884		1,634,258.75
		$5,605,190.53
From which deducting appropriations for—		
Dividend at 1¾ per cent., paid April 15	$1,399,794.00	
Interest on bonded debt	135,587.57	
Sinking funds	19,991.00	
		$1,555,372.57
Leaves a surplus April 1, 1884, of		$4,049,817.96
The net revenues of the quarter ending June 30, instant, based upon nearly completed returns for April, partial returns for May, and estimating the business for June, will be about		$1,750,000.00
Add surplus, April 1, as above		4,049,817.96
		$5,799,817.96
For which appropriating for—		
Interest on bonded debt	$124.000.00	
Sinking funds	20,000.00	
		$144,000.00
Leaves a balance of		$5,655,817.96
It requires for a dividend of 1¾ per cent. on the capital stock		1,399,800.00
Deducting which, leaves a surplus, after paying dividend, of		$4,256,017.06

The present quarter closes the fiscal year, which will exhibit gross earnings within a fraction of $20,000,000—about half a million more than the last year; but on account of the extraordinary expenses during the strike in July and August the net will not be quite so large. The last and present quarters show an excess in net earnings over the corresponding quarters of last year.

There has been expended in the construction and purchase of new lines and other telegraph properties, including underground wires, pneumatic tubes and new buildings on Fifth avenue and on Broad street, since January, 1881, and up to the close of the present quarter (as near as can now be ascertained) about $5,700,000. Of this $1,225,915.22 was appropriated and paid out of the net revenues, during the first three-quarters of 1881. Since the resolution that other provisions would be made for the cost of construction and new properties added to the plant, as published in the quarterly statement of March, 1882, there have been advances made from the surplus to the construction account amounting to $3,300,000, and the proceeds of one million of bonds sold were also applied to that account. The company has no floating debt.

In view of the preceding statements the committee recommend the adoption by the board of the following:

Resolved, That a dividend of 1¾ per cent. on the capital stock of this company be hereby declared payable on and after the 15th of July next, to stockholders of record at the close of the transfer books on June 20 inst.

Resolved, That for the purpose of the dividend hereby declared the stock books of the company in New York and London be closed at 3 o'clock on the afternoon of June 20 inst. and be reopened on the morning of July 2 next.

New Telephone Transmitter.

Mr. Webster Gillett, whose long-distance telephone apparatus was described in the issue of THE ELECTRICAL WORLD of April 19, 1884, has shown us a telephonic transmitter which he has recently invented. He has used it in talking between New York and Cleveland with great success.

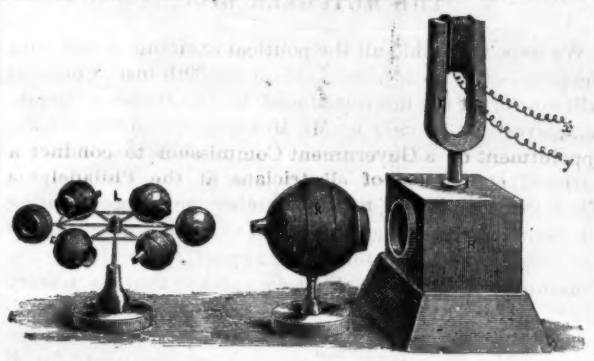
Two discs of brass, each about the size of a silver five-cent piece, are separated by a section of soft-rubber tubing about one-quarter inch long, and of the same external diameter as the discs. The cylindrical space in the tube is filled with minute grains of carbon free from dust. The discs and tube are mounted in the centre of a hard-rubber ring. Upon one side of the ring is a cross-bar in the centre of which is a set-screw with its end against one of the discs. On the other side of the ring the diaphragm is held by a screw cap which is hollowed and perforated to form a mouth-piece. In the centre of the diaphragm is a set-screw, the end of which presses against the other disc. The pressure of the discs against the rubber-tube section, and its contents of carbon, is regulated by these set-screws. The diaphragm is a thick disc of tinned iron. The battery wires are connected with the two discs, one to each.

A cap covers the first side of the ring, and the ring has a handle projecting radially from it. The whole has the general appearance of a disc about four inches in diameter and one inch thick, with a handle for the purpose of use. The wires run through the handle, and a flexible double-conductor admits of as free movements as with the usual receiver.

The instrument is very handy for those who desire to transact business by telephone while sitting at desk or table, instead of standing with face to the wall in a decidedly undignified attitude.

Dworak's Sound Radiometer.

A very interesting conversazione was given in London by Prof. Huxley as President of the Royal Society, on the evening of the 7th ult. One of the most interesting contributions to the objects exhibited was Herr Dworak's sound radiometer, which we illustrate on the present page, and which was exhibited by Mr. W. H. Preece, F. R. S. In this apparatus, which attracted considerable attention, a wheel is set into rapid rotation by the sound waves produced by a vibrating tuning fork. Referring to the figure, *T* is a large tuning fork mounted on a resonating chamber *R*, and maintained in continual vibration by an electro-magnet *C* fixed betwen its prongs, to which an intermittent current of electricity is transmitted by a contact breaker consisting of a similar fork tuned in unison with *T*, with which it is connected by the wires *x* and *y*. Opposite the orifice of the resonating chamber *R*, and on the same horizontal axis, is placed a Helmholtz resonator *K*, and in front of its small end is placed the instrument shown at *L*, which consists of six little Helmholtz resonators fixed round the circumference of a wheel which is poised at its centre on a needle point so as to be capable of rotation in a horizontal plane after the manner of a compass card. The little resonators are attached to the wheel in such a manner that their axes are tangential to their circle of rotation, their smaller ends pointing in the direction in which they revolve. When the tuning-fork *T* is set into action the air within the chamber *R* takes up the vibration and the sound is greatly reinforced, and this is more marked if a mass of cotton wool or soft rubber be interposed between the chamber *R* and the table. The action of the Helmholtz resonator *K*, is to take up the sound waves and to concentrate them in the direction of the revolving instrument *L*, and this effect is so strongly produced that, if the finger be placed a short distance in front of the smaller orifice of *K*, a sensation is felt which is indistinguishable from that which would be produced by a rapidly intermittent jet of air issuing from the nozzle. The rotation of the wheel *L* may be due to the fact that as the air within each of the little resonators *L*, is thrown into vibration under the influence of the sonorous vibrations, and in the direction of its axis, and as it is freely open to the external air twards one end of that axis, it is probable that the energy of motion expends itself partly on the envelope and partly on the air, and the former receiving a greater proportion over that part of its surface which is opposite to the large orifice than in the contrary direction, rotation takes place.



We are, however, rather inclined says *Engineering*, to which we are indebted for these details, to place the phenomenon in the same class with those discovered by Professor Bjerknes, and illustrated in the beautiful experiments of himself and his son, and to attribute the action to the effect of one vibrating body upon another through the intervention of a common vibrating fluid medium in which they are immersed. It is, however, hardly within the scope of an article, such as the present, to enter into a consideration of different hypotheses by which the action of this most interesting instrument may be explained, but we may on a future occasion have more to say upon the subject.

The Erie Company's Business.

The stockholders of the Erie Telegraph & Telephone Company held their annual meeting at Albany, N. Y., on June 9. The treasurer's report shows that the earnings and expenses for ten months ending March 31, 1884, were: Earnings, $427,931.38, and expenses, $194,282.57; showing net earnings of $233,648.81. Dividends paid, $172,250. The company has 2,000 shares of treasury stock which it had intended to sell for construction uses, but the market was too low, and construction has been carried on the last six months from earnings and borrowed money. Had the expectation of future growth been less the directors would have advised a suspension of dividends for a time in the interest of construction, but they now expect to be able to continue dividends and construction and to soon reduce the debt. The practice is to charge to running expenses everything which does not make a permanent addition to the plant. The average receipts per subscriber for exchange rental was $52.40 per annum, and the gross earnings per subscriber per annum $60.41. Net gain of subscribers for ten months, 3,203. Total number of subscribers connected March 31, 1884, 8,943. Number of miles of extra territorial line built and purchased, 3,143. The directors' report says the consolidation has been of advantage, and that the company has, since the consolidation, purchased the Southeastern Dakota Telephone Company and the Arkansas Telegraph Company, and is negotiating for the purchase of the Sunset Telegraph Company, in Texas. Extensive improvements have been made, especially in the Northwestern territory, and the entire property is now in excellent condition. The Southwest increased 70 per cent. in subscribers, the Northwest 35 per cent. and the Cleveland district 33 per cent. The increase in the whole has been about 50 per cent., exclusive of the 319 acquired by purchase. A ballot for directors resulted in the election of the following-named: William A. Ingham, Charles J. Glidden, Loren N. Downs, A. A. Coburn, Francis Jewett, Charles E. Adams and A. C. Russell, of Lowell, Mass.; Wesley A. Gove, of East Boston, and W. J. McKinnie, of Cleveland, Ohio. Charles J. Glidden was elected Secretary and Treasurer. At the meeting of the directors William A. Ingham was elected President. William A. Ingham, Charles J. Glidden and Loren N. Downs were elected Executive Committee. Loren N. Downs was appointed General Manager, and William H. Bent, Attorney.

The Safety of Secondary Batteries.

BY R. H. BROWNE, MATTOON, ILL.

Not long ago, in an issue of THE ELECTRICAL WORLD, I noticed an article from the pen of Mr. R. G. Du Bois in defence of the storage or secondary battery system. I cannot see wherein the secondary system can be dangerous in the least, as a constant current flowing would have to be extremely strong to affect any one without some brake attachment for opening and closing circuit quite rapidly, even should they form unknowingly, a good ground; a battery of ordinary size, say from 25 to 30 elements, would on opening and closing circuit by taking the electrodes in the hands give only a slight sensation.

I had occasion to remove a Brush accumulator a short time since, of 22 elements, that I had been supporting ten Swan lamps with, and on disconnecting the poles the current would leap from one to the other as they were separated for some distance. Taking the naked electrodes, one in each hand, and connecting and separating them, holding them at an ordinary carbon distance as in the arc lamp, the molten copper would drop from the points of a No. 8 copper wire; but on too long a continuance of this the electrodes would become so heated they could not be held for about four inches back from arc.

On taking two of the ordinary carbons and coiling the wire around them they would give a brilliant arc, and the points for a half inch or more back were heated to incandescence, and were red a considerable distance farther back from arc—all while the electrodes were being held in the naked hand and current was passing through arms and body on the interruption of circuit. Not this experiment only, but others similarly tried, show the secondary battery to be perfectly harmless.

Ambulance Signals in New York.

Attention has been called this week to the desirability of prompter ambulance service, by the bleeding to death of a man at the Cosmopolitan Theatre while waiting for medical assistance. It appears that there are only two ways by which an ambulance can be called by a policeman. He may either go to the station house or the nearest elevated railway station. In the first case it might happen in one of the upper precincts that the station was two or three miles off, and no way to get there but to walk; and in the latter only the Third and Sixth avenue stations would be open late at night. From the police station houses the call is telegraphed to Police Headquarters, and thence transmitted by telephone to the hospital in the district from which the call came. When sent from the elevated stations, which can only be done by an officer who leaves with the operator a card with his name and the date on it, the message is sent by telegraph to either the Bleecker or the East Houston street station. These stations are connected by telephone with Police Headquarters, where the call is transmitted as before. The places from which ambulance calls can be sent, except in cases of fire, are limited to the 105 "L" railway stations, the thirty-five police stations, the Tombs, Essex and Jefferson markets and the Fifty-seventh street and Harlem Police courts. In case of fire an ambulance may be summoned by a fireman from any fire-box by giving the proper signal. No police officer is allowed to do this, as it necessitates the opening of the inner door of the box.

In conversation with a reporter on the subject, Telegraph Superintendent James Crowley remarked: "I think it would be a most excellent arrangement if the police were allowed and instructed to use fire-boxes to call ambulances in any case. It would not be necessary to change the mechanism of the box at all, simply the signal. I would not be in favor of allowing citizens to use them for that purpose, as there would be too many false fire-alarms. What is really needed is more ambulances rather than more stations."

Electrical Workshops.

The means for producing electrical apparatus have advanced with the art of the electrician, as is shown by the many establishments which have within a few years come to the front as manufacturers of all which pertains to electricity. When Henry, Morse and others experimented in electro-magnetism forty years ago, and up to within a very few years, every little detail of any electrically experimental apparatus had to be made especially for the piece in hand. Wire had to be wound, for insulation, by hand in a manner which produced that which could not be sold to-day. Batteries and connections were made, as it were, piece by piece, by hand alone. Magnetos, keys, sounders, relays, etc., were made singly, at a cost far exceeding the present selling price.

Thanks to the energy, ability and common sense of the proprietors of machine shops here and there, special tools and machinery have been devised for making the several parts of apparatus after exact sizes and patterns with much less manipulation, in less time, and with far less cost. These improvements in manufacture have not in all cases followed the demand for the articles manufactured, but, on the contrary, have created, so to speak, the demand itself by reason of the cheapness of the articles produced. As railroads induce settlement of new sections of country by reason of the increased facilities of intercourse afforded by them, so do cheap and reliable means of manufacture of electrical apparatus increase their sale by reason of lessened prices for that which was previously a convenience, but now a necessity.

We are led to these remarks from a visit we recently paid to the establishment, 257-259 Water street, Brooklyn, of Mr. James Brady, who is so favorably known as a manufacturer of electrical apparatus in the shape, mainly, of dynamos, motors, lamps and experimental apparatus. Within our knowledge, Mr. Brady was one of the first to manufacture electric light machinery and apparatus in this country. For Fuller, Maxim, Sawyer, Holcombe, Olmstead, and others who were first in experimental and practical work in electric lighting from 1876, he made dynamos, lamps, motors, inductors, etc., and was always enthusiastic in his efforts to make everything in a substantial, workmanlike manner. Consequently he has in his shop special machinery and tools for all classes of electrical work, from a seventy-arc-light dynamo down to the most minute screw in a lamp.

Within our knowledge, also, he has made many hundreds of dynamos of various styles and sizes, and lamps by the thousand for these various dynamos.

A visit to his establishment well repays the expert and the amateur by the views obtained of the many ingenious devices for saving labor and producing effective apparatus.

We illustrate as an example of good workmanship a new instrument made by him in large quantities. This instrument is of use to our electrical friends who are making money which they desire to protect.

THE WILLIAMS AUTOMATIC CHECK PUNCH.

The upper disc of the Williams Check Punch carries eleven radial levers to which are attached an equal number of punches which are moved vertically through guides by the levers. These punches are shaped at their ends for the numerals 1 to 0, and the eleventh punch is shaped to the $ mark. To prevent "raising" a check, a dollar mark, and the suitable numerals to express the number of dollars for which the check is drawn, are punched through and from the paper as shown by the figures at the head of the check.

The check is placed under the foot as shown, but in the desired position, and then the operator takes the lever opposite the proper numeral, and by it rotates the disc until the lever comes over the vertical slot in the case, when he depresses the lever, and thus forces the punch through the paper and through the die under it. He removes the pressure, the lever rises, and he then takes hold of the next appropriate lever, repeats the operation just described, and so on until the desired number of punches have been made to indicate the sum of the check.

The turning of the levers turns the guides for the punches, and also the dies, because these several parts are all in line on discs which have a common axis.

For the manufacture of these instruments Mr. Brady devised many ingenious special tools for making the various parts of absolutely invariable size, so as to be interchangeable. For instance the punches are formed by milling tools instead of by hand, the usual way. This item alone effects a saving of over ten dollars in the manufacture of each instrument.

He devised special machinery for the manufacture of the many thousands of couplings used to connect the wires used in the cables of the Brooklyn bridge. Steel wire blanks were placed in a machine which automatically bored them lengthwise, tapped them from the two ends with right and left threads simultaneously, and finished them with suitable ends.

We speak of these things and call attention to his advertisement because we desire to point out to such of our readers who may want electrical apparatus made, one of the best places where they may be assisted in the practical development of their ideas, and be supplied with their manufactured goods cheaply and reliably.

A Strong Telegraphic Combination.

Negotiations were completed last week between Henry Cummins, Second Vice-President and General Manager of the Postal Telegraph and Cable Company, and G. S. Mott, President and General Manager of the Bankers & Merchants' Telegraph Company, for an alliance whereby the two companies could be operated together. On Friday the Executive Committees of the companies agreed upon a contract, and on Saturday, the 7th inst., the Board of Directors approved it.

Mr. Cummins said that the companies would do business in common, but the organizations would be kept separate. Mr. Mott would be the general manager of both companies. The contract was in the nature of a pooling arrangement, running for 25 years from June 7. The earnings and expenses would be divided. Where both companies covered the same points, the division of business would be by percentages. The expense of both organizations, Mr. Cummins added, would be greatly reduced by the arrangement. Their offices would be together at all points. Mr. Cummins made also the following statement of the extent and plans of the allied systems:

The union of these two companies brings under one control about 9,000 miles of pole lines, with about 55,000 miles of wire now completed and in operation, and there will soon be completed 3,000 miles more of pole line and 21,000 miles additional wire, making a total of 12,000 miles of pole line and 76,000 miles of wire.

This combination also includes a complete stock quotation or ticker system (the Commercial) now in operation in this city and Philadelphia, and also soon to be started in Chicago and other cities; also a complete telephone (the McDonough). The whole forms a complete system of land lines and necessary adjuncts, which will be operated in connection with the Bennett-Mackay ocean cables.

In this arrangement between the two companies, neither assumes or becomes responsible for the fixed liabilities of the other, but their joint control and management will be composed of the best talent and financial strength of both companies. The expense of operating will be reduced as nearly as possible to the cost of running one company, while the business will be extended to the fullest capacity of the united lines, and run with the greatest possible economy. And, inasmuch as these lines reach at least 80 per cent. of all the paying telegraph business in the country, and are to be allied with the great Atlantic cable system of the Commercial Cable Company, having connections throughout Europe, they can in all probability be maintained on a dividend-paying basis.

The Executive Committees of the two companies will form a joint committee for their united management. E. Burton Hart, John Anderson and Franklin Edwards have entered the Bankers and Merchants' Board to represent the Postal. They took the place of W. W. Maris, George Putnam Smith and S. D. Houston. In addition A. W. Dimock, G. S. Mott, the President, and J. G. Case, the Treasurer of the Bankers and Merchants' Company, will represent in that board the Postal Company's interests. That gives the Postal a representation of six out of nine directors. The Bankers and Merchants' controls the American Rapid and Southern Telegraph Companies, which will be operated with the others.

The Postal Company's Board of Directors is composed of 16 members. There is a vacancy in it, which will be filled by the election of Mr. Mott. Where the Bankers and Merchants' lines now in course of construction duplicate the lines of the Postal Company, they will be abandoned, although the general work of construction of both companies will be kept up. The line of the Bankers and Merchants' projected to Quebec will be stopped at Niagara Falls for the present. John W. Mackay, the President of the Postal Company, who is in California, has been kept apprised of the negotiations, and he has approved of the pooling agreed upon.

To all points covered by the Postal Telegraph and Cable Company the rates of the Bankers and Merchants', with which it is allied, will hereafter be the same—20 words for 25 cents. The reduction was made Saturday, and covers business between New York and Washington, St. Louis and Chicago.

The Electro-Deposition of Iridium.*

BY JOHN M. BATCHELDER.

While engaged in some details relative to the engraving and printing of the charts issued by the Coast Survey in 1857, it occurred to me that engraved copper plates might be improved by the electro-deposition of a metal harder than the copper upon the surface of the plate, the object being the protection of the surface from oxide, greater durability, ease of wiping, and a retouching of the lines.

I could hardly hope that the process would be applicable to the very fine intaglio lines, but it was found that they were uninjured, the deposit taking place first upon the prominent edges or borders of the lines, and not in the cut.

The metal selected for this purpose was iridium, which was procured from the United States Mint. The solution for the bath is prepared as follows:

Iridium and osmium, which have been separated from other ores, are fused with about three times their weight of nitrate of potass for about one hour, at a bright red heat, and the contents of the crucible poured upon an iron plate. After cooling, the mass is broken into small pieces, which are then to be treated with nitric acid in a glass retort having a condenser, by which the osmium is separated in the form of osmic acid; the iridium remaining in the retort is to be treated with hydro-chloric acid after removing the nitrate of potass by crystallization, and we then have the chloride of iridium.

The solution should contain about one-eighth of an ounce of iridium to a gallon of water, to which about one-quarter pound of sulphuric acid should be added. The plate, when immersed in the solution, is connected with the battery in the usual manner. On its removal from the solution it is found coated with iridium in the metallic state, and closely resembling the common steel plates.

The plate sent with this is the first one of large size (21 in. × 16 in.) that was thus coated; it has been exposed twenty-seven years, without wax or other protection, and it will be noticed that its surface is still brilliant and uninjured.

In use for printing it was more easily wiped than a copper plate, the surface, in this particular, being about the same as that of an engraved steel plate.

This plate is of copper, deposited upon the copper "alto" or relief plate, which was made by deposit upon the original hand-engraved plate.

All of the manipulations for the production of this plate were very skillfully conducted by Mr. Luther L. Smith, of New York.

Soon after this plate was finished and in use, I learned that several small copper plates for book illustrations were imported by Messrs. Appleton & Co., of New York. It was stated that the engraved surface was coated with iron, but I have no particulars relative to this subject.

In a report of an address before the "American Institute of Mining Engineers," in February, 1884, by Dr. W. L. Dudley, he states as follows: "For the past three years we have been experimenting on methods of plating with iridium, and about one year ago we succeeded in obtaining a bright reguline deposit of iridium on base metals."

* A paper read before the Society of Arts, Boston, Mass., May 22, 1884.

Exit Bell.

To the Editor of The Electrical World:

SIR: I have followed carefully the able articles in your columns by Prof. S. P. Thompson and S. Berliner, Esq., upon the "Child in the Wilderness," or the invention of the telephone.

As I understand the argument, Prof. Thompson claims the honor or the invention for Prof. Reis, while Mr. Berliner claims it for Prof. Bell.

In your issue of June 7th in the communication by E. Berliner, headed "Exit Reis," Mr. Berliner states, "Reis cannot be taken as the inventor of *even the musical telephone.*"

It seems to me that this is an admission on the part of Berliner that he believes that a "musical telephone" was invented by M. Bourseul, and as early as 1854.

Now, Mr. Editor, will you or Mr. Berliner kindly inform me, through your columns, what a "musical telephone" is; and what the difference is, between a "musical" telephone, and what is commercially known as "*the telephone?*"

I have always understood a "musical telephone" to be an apparatus for transmitting and rendering musical tones, but according to an article, "Bourseul and Bell," published in your columns of date of 7th inst., part of which, Mr. Berliner states, is the translation of a document that appeared at Frankfort, September 28th, 1854. In that document M. Bourseul's invention is stated to be "nothing more or less than the electrical transmission and rendition of the *spoken word*," and when such an authority as Berliner calls *this* a "musical telephone," I am driven farther into "the wilderness" than Berliner's "child," and I must seek a guide out.

In view of the fact also, that Berliner admits Bourseul's prior invention, and such invention is stated to "*concern nothing more or less than the electrical transmission of the spoken word*," I cannot understand why, if on this evidence, it is "EXIT REIS," it is not also EXIT BELL; can you, Mr. Editor? CHARLES A. RANDALL.

NEW YORK CITY, June 9th, 1884.

"You Can Have Another Million."

An officer of the Postal Telegraph Company told, this week, a characteristic story of Mr. J. W. Mackay, the bonanza king, who virtually owns that company. It appears that Mr. Mackay was in the wilds of Arizona looking at some mining property when the recent financial cyclone in Wall street occurred. He was nearly two hundred miles beyond the reach of the post-office or the telegraph, and knew nothing of the storm troubles in New York for several days. When he returned to civilization the first thing the man who owns a gold mine did was to telegraph to New York something to this effect:

"Is the company all right? Don't let any man wait an hour with a claim against us. You can have another million immediately if you want it."

"We didn't want any money," said the official; "but I think I know of some concerns to whom an offer like that would have been a godsend just about that time."

DEPARTMENT OF INQUIRIES.

While we are pleased to answer in this department all questions of general interest to our readers, and do so without charge for time or expense, we must request those of our patrons who desire information for their personal interest, and who cannot be properly answered in this way to send us with their request a small sum, say from $1 to $5, to pay for the time and the expense incurred for their exclusive benefit.

71.—HYDROMETER, ETC.

"Please explain the construction of an acidimeter and a hydrometer, and their uses in connection with batteries." B. B.
LAKE, F. & P. M. R. R.

Acidimeters, Alcholometers, Hydrometers, Lactometers, Alkalimeters, Salometers, etc., etc., are specific names applied to instruments used for determining the specific gravity of liquids, such as water, and solutions in it of various substances. The variations are, in the main, those of graduation. They are all hydrometers, but some are called by the names we have given to denote their special use. The different scales of graduation are called after their originators, as "Baumè," "Twaddle," etc., and sometimes made and called to denote percentages of acids or salts in solution, or to denote specific gravity as compared with that of water. Their use with batteries is to determine whether the proper amount of acids or salts are in the battery liquid at setting up the battery, or whether overcharged with salt when they have been used for some time. The sealed glass-tubes would lie lengthwise on the liquid were they not weighted at one end. The weight makes them stand upright in the liquid and where the stem coincides with the surface of pure water, at 60 temperature, in which it is immersed, the zero mark is made. For liquids heavier than water, like solutions of acid and salts, the mark should be near the top of the stem, because when immersed in such, the hydrometer, by whatever name it may be called, stands higher in such liquids. When the instrument is to be used for liquids lighter than water, like alcohol or whisky, the zero mark, determined in pure water as before, should be near the bottom of the stem, because in such liquid the instrument sinks to stand deeper therein. More or less weight at the lower end determines the depth to which the instrument will stand in pure water.

72.—SIZE OF WIRES, ETC.

"What is the formula for computing the size of wire when the E. M. F. is doubled, so as to sustain the same loss in transmission? Example: Suppose a single dynamo of E. M. F. 100 volts requires 27,225 sq. mils, with 10 per cent. loss, what will be the sq. mils for same loss with two dynamos in series, and E. M. F. 200?" L. R. C.
MENDOTA, Ill.

The loss in energy in a given length and cross-section of conducting wire is in proportion to the square of the current passing through the length of wire. If, when you couple your dynamos in series, you also intercalate resistance in a part of the circuit other than the part which you enquire about, so that the total resistance will be doubled, no more amperes of current will flow in the circuit than before, and there will be no more loss than before in that part of the circuit. But in the total circuit there will be twice the expenditure of energy because it is of twice the resistance it was at first.

If you double your electromotive force and current, and desire to have only the same percentage of loss of energy in the conductor, you must make the resistance of the given length of the conductor one-quarter as much as before, and expend the remainder of the energy in doing useful work, like running a motor, etc. Remember that the resistances of conductors of given length is in inverse proportion to their cross-section in sq. mils. These formulas:

Energy lost on any conductor $= R \times C^2$; and $R = \frac{\text{sq. mil.}}{\text{length}}$;

are the useful ones.

73.—TELEPHONE CROSS.

"Last September, among our usual list of troubles, we discovered the following curious cross which we would be pleased to have explained:

"Two lines were crossed in a tree top by a small piece of bright broom wire resting upon them, in such a manner that after connecting an instrument to each line in the central office and leaving the lines and subscriber's instruments outside of the office in their usual condition, except as far as the cross was concerned, we found that a person at one central office instrument could ring the bell of the other instrument in the central office all right, but it was impossible to talk to each other or hear the slightest sound except the usual induction.

"Several persons tried it with the same result. All the instruments and lines were in good order as proven by connecting with other instruments. After the broom wire was taken off the lines were in their usual good condition. One line was 1½ miles long, the other 3 miles, and the broom wire about ½ mile from the central office.

"Will you please explain why we could ring all right over this cross but could not talk?" CENTRAL OFFICE.
DENVER, Colo.

There were two extra "grounds," and perhaps a th ird through the tree, to each of the central office transmitters and receivers. Probably, then, the currents from the transmitters were not strong enough to give appreciable effects at any one of the three receivers. But the magneto calls furnished current enough to ring the bells at central office and perhaps those of the two subscribers whose lines were crossed.

74.—GALVANOMETERS.

"Will you please publish a short dissertation on the galvanometer? I only want to know what it is used for and what it accomplishes." S.
ELBERTON, Ga.

The galvanometer was originally intended to measure the current of electricity passing in the circuit in which the galvanometer was placed. By this we mean the measurement of the cross-section of current, so to speak, without reference to time. Or, in other words, the "quantity" of current, as it used to be called. But now "quantity" implies time, and the galvanometer only shows the size of current at the instant. The unit for this is called "ampère." The unit for quantity is called "coulomb," *i.e.*, the ampère for one second of time. The galvanometer was necessarily graded by noting during the time of use the amount of chemical action which the current effected in a voltameter in the same circuit for given deflections of the needle of the galvanometer.

Nowadays the galvanometer is used for many purposes other than the *measurements* of currents. But they are all, fundamentally, the same instrument, namely a magnetic needle balanced on a pivot and deflected to a greater or less degree by currents of electricity flowing in a neighboring conductor. There are many names given to these galvanometers to denote the special purposes for which they are used. Simple "test" galvanometers are used to denote the existence of a current of electricity without reference to its size or value. Those for measuring quantity without reference to time are called Ammeters. Those for measuring differences of potential are called Voltmeters. Then there are Ohmmeters, for measuring resistances. In fact, they are used for the determination of all the points relating to dynamic electricity which the electrician desires to know in his art.

As no one construction of galvanometer will answer the requirements, an electrical laboratory is supplied with many kinds, and their uses and manipulation have been made the subject of many books. Their main, essential differences consist in the lengths, sizes and modes of presenting the wires to the needles. Ammeters use wires of low resistance and short length, and Voltmeters use wires of high resistance and great length.

FOR A GERMAN CITY.—The German Edison Company have been negotiating with the Senate of Lubec for a central lighting station in that city. The company stands ready to put in the plant provided the use of 12,000 lights of 16 candle power each is guaranteed for five years, and a further guarantee of a monopoly of the business in the city for thirty years. It is estimated that the plant will cost the company $75,000.

THE TELEGRAPH.

TO SUCCEED AUGUSTUS SCHELL.—At the quarterly meeting, on the 11th, of the Western Union Telegraph Company, George D. Morgan was elected a director to fill the vacancy caused by the death of Mr. Augustus Schell.

NEW ENGLAND ASSOCIATED PRESS ELECTION.—At a meeting of the New England Associated Press at Boston, Mass., on June 11, the following officers were chosen for the ensuing year: William W. Clapp, President; R. M. Pulsifer, Secretary; Executive Committee, William W. Clapp, R. M. Pulsifer, S. A. Hubbard, J. L. Shipley and A. P. Moore.

TAKING IT COOLLY.—The Baltimore & Ohio Telegraph Company, having been ordered to remove their poles from the streets of Chicago, will proceed to place their wires underground as soon as a route can be agreed upon. It is said that the company desired to lay its cables along their streets which have been only recently permanently paved with granite blocks. This privilege was positively refused them.

A RAILROAD TELEGRAPH SCHOOL.—St. Louis is to have a railroad telegraph school. The pupils are to be instructed in telegraphy and railroad station-agency work. The tuition will be $25 a quarter. Upon graduation the student will be provided a place on the Gould lines for practice until a vacancy occurs for employment. Graduates will have preference on the Baltimore & Ohio, Chicago & Alton, Lake Shore & Michigan Southern, as well as upon the entire Missouri Pacific system.

NOT TO BE A RESPECTER OF PERSONS.—A telegraph company formed to transmit stock quotations and other news may not refuse to furnish such news to any one wishing to subscribe for it, according to the decision of the New York Supreme Court in the recenly decided case of Friedman, *et. al.*, *vs.* The Gold & Stock Telegraph Company. It appeared that the plaintiffs had the instruments to which the lines of the defendant were applied for the transmission of stock news, and that they were willing to pay such price for the privilege as should be established. The Court, while remarking that the case was an entirely new one in the courts of New York, held that "upon principles of justice a public corporation" (such as the defendant was assumed to be) "should make no distinction in respect to persons who wish to partake of the privileges which it was created to furnish," and that the corporation could "either be deemed to have assumed to forward to the plaintiffs every message transmitted over its wires, or to be a public corporation to do the acts it undertakes to do in the way provided by it by means of the line erected for public use."

THE TELEPHONE.

WIRE FOR TELEPHONY.—This somewhat vague paragraph is floating about: A discovery has been made in wire drawing which promises great results in telephoning. The wire, when drawn, incloses a core of copper within a protecting outer shell of steel. It is rolled in the usual manner, but the steel bloom has a copper centre and both metals are drawn together. It seems likely that through this ingenious composite filament we may be able to send spoken messages to Chicago or San Francisco or even London as readily as we now send them across the river.

THE TELEPHONE AS AN EXERCISER OF FAITH.—Most people regard the telephone as a good tester of a man's patience. Henry Ward Beecher thinks that it makes largest demands on faith. At a meeting of the Baptist Conference this week, referring to the telephone, he said he did not yet believe in it, because, as he intimated, it required too great an exercise of faith. He passed on to speak of electricity, "conveying swift messages through the air and under the seas," and "in its latest application brought to the purposes of illumination, and seemingly in this and other respects capable of as great development as the power of steam."

MEXICAN TELEPHONE INTERESTS.—The Boston *Herald* of the 6th says: Mexican telephone is steady at 1⅛. The management is advised of a draft for $1,000 representing the net profits of the City of Mexico exchange in May, and has assurances that a similar sum will be forthcoming monthly. There are 503 sets of instruments in actual use in that city and there are applications ahead for more. A contract for instruments was executed today between this company and the American Bell, whereby the latter agrees to supply the former exclusively with instruments for use in the republic of Mexico for three years at a fixed price said to be considerably less than under the former contract, the Mexican company agreeing to take at least 1,000 sets per year.

TELEPHONING FROM MOVING TRAINS.—Mark F. Parish and S. J. Munn, of Niles, Mich., have succeeded in nearly perfectiug an electrical railway signal, by which a collision between trains will be rendered absoutely impossible. The above gentlemen are the patentees, and C. W. Millard, of the same place, has purchased one-third interest in it. Numerous experiments have been made by the parties in Jackson in the presence of railroad officials, members of the press, and others, and everytbing worked to the satisfaction of all parties. These gentlemen say they will have no trouble in operating a telephone between trains of the same circuit, for the instant another train comes on the circuit is formed and the bell in the cab of each engine will ring, the same as in any telephonic connection. It will also enable the trainmen to communicate with the stations each way in case of accident The gentlemen owning the signal say it works more satisfactorily than they thought it would, and great things are anticipated for t.—*Detroit Free Press.*

TELEPHONE NEWS FROM NEW BRUNSWICK.—Mr. C. F. Sise, vice-president and managing director of the Bell Telephone Company, and L. B. McFarlane, manager of the Eastern division, who have been spending a few days in the city, left for Montreal last night, says the St. John, N. B., *Telegraph* of recent date. Their visit here has been of special interest to Mr. J. H. Wagstaff, who has for only a short time been agent for the company here. By close attention to business, both in the interest of the company and the of subscribers, Mr. Wagstaff has so improved the agency as to win the confidence of the managers, and has been rewarded by the appointment to the position of district superintendent, which covers the management and inspection of the Maritime Provinces, with the head office at St. John. Mr. Wagstaff will continue to control the affairs of the St. John agency.

This advance has been earned within ten months and without any previous experience in the business, and is, therefore, more to be valued. We are glad to chronicle any advance of our citizens, and more especially as St. John has been signaled out for the head office, the Halifax agency being almost as important as that of St. John. The company will shortly remove to new offices in the Bostwick building, which are being specially fitted up for them, and, when finished, will be very complete and comfortable.

A TELEPHONE INSULATOR.—We find the following in the London, Ont., *Free Press* of May 31: The *Free Press* office and the Carling Brewing & Malting Company's establishment have had the Tringham insulator put on their telephone lines, the glass ones formerly in use having been removed. The result is something marvelous. The voice is clear and distinct; no effort in required to speak or hear, and all necessity for "What do you say?" has been removed for a reasonable distance. The telephone has been connected with this establishment since the institution of the service, and it is a matter for congratulation to be able to say that at no time have messages been received as distinctly as to-day. The improved insulator is a very simple contrivance, and consists of a small block of wood with a saw-cut about half-way up the centre, in which is inserted the wire, and around it is a piece of rubber. A nail goes through the block and draws the saw-cut together, clamping the wire and rubber as if in a vise. Another form of the insulator consists of a top-pin, which goes into a cross-arm. This resembles very much a clothes-pin. The wire and rubber passes up the slot; the pin is put in the hole of the cross-arm, then driven in, clamping the wires firmly, doing away entirely with tying the wire on the glass. The difference in cost is said to be about 700 per cent. less than the glass. This fact, in addition to the improvement alluded to, makes it a valuable patent. Mr. Tringham has patents secured for Canada, England, the United States, France and Belguim.

THE ELECTRIC LIGHT.

BRIDGEPORT, CONN.—The Bridgeport Electric Light Company have increased their plant of Thomson-Houston arc lights to a full hundred. This light is gaining a very strong hold on the affections of the New Englanders.

CANNOT BE EXCELLED—Mr. J. S. Watson, Superintendent of the Cunard Steamship line, says: "We now have electric lights, three different kinds, in the Servia, Aurania, Pavonia, Cephalonia, Bothnia and Gallia, and we have every reason to be entirely satisfied with them All new steamships will be furnished with them. They are economical, give a better light than gas or oil, and, best of all, give out no heat."

CHEAPER THAN GAS.—Mr. Alan A. Campbell Swinton says it is better and cheaper to light small towns by means of electricity than by a coal-gas system. He compares the equal illuminating effects of gas and electricity in portions of the British Museum, and finds that, while the former is estimated to cost $4.22 an hour, the latter has actually cost $1.44 an hour for a total of 18,800 candle-power, using the pendulum arc lamps.

PHOTOGRAPHING AN AUDIENCE.—A dispatch of June 10, from Denver, Col., says: The one thousandth performance in the Tabor Grand Opera-house took place last night. The great audience was successfully photographed with the aid of 50 electric lights temporarily placed in the auditorium. A copy of the photograph will be given to each lady in attendance as a souvenir. Rhéa in the "School for Scandal" was the attraction.

PORTLAND, ORE.—Mr. H. W. Cole writes: "I have organized a company in this place with a capital stock of $100,000; paid up, $50,000. We are putting up a plant of 150 arc lights, and are arranging for a large incandescent plant. This is the first place of any size of the U. S. Company's system erected on the Pacific coast. We will use the Westinghouse engines. 11 × 11, three in number, each running a 50 Weston arc light dynamo, belting direct. Spokane Falls and Seattle, Wash. Ty., will also be lighted by the U. S. Company's system. I have also sold quite a number of isolated plants, both arc and incandescence. P. F. Morey is the manager, and A. J. Coffee, Jr., formerly of the telephone company, is the electrician of the Portland Company. Every light is contracted for."

CRUCIBLES AND THE ELECTRIC LIGHT.—An interesting application of the electric light is about to be made at the well-known crucibles works of Messrs. Morgan & Co., of Bridge road, Battersea. Hitherto it has been the practice to examine the interior of snewly made plumbago crucibles by the aid of a gas flame in order to discover any flaws there may be in the material, but the use of a gas flame for such work is both clumsy and disagreeable owing to its flaring nature and the heat and fumes which arise from it and blow into the faces of the workmen. Mr. Henry Thame, the inventor of a new primary battery, is about to apply the electric light to the purpose. An incandescence lamp, fitted with a small reflector behind, will take the place of the gas jet with the advantage of clearness, coolness and convenience. It can be inserted into the inside of the crucible and the internal surface examined at leisure. Five of these lamps are to be installed and will be fed by the "chlorochrome" battery, as devised and arranged by the inventor. This battery is remarkably constant, durable in its action and will keep the lamps going consecutively for forty-eight hours, if need be, without recharging.

A COMPANY FOR MOBILE, ALA.—Talking to a reporter of the Mobile, Ala., *Register*, Mr. Charles W. Hurley, of that city, says: "I have seen some of the leading citizens, and they have all come in—that is, all I have seen so far—and we are to get up a stock company of $15,000, buy a plant and go to work. We will locate centrally, in a place better than the old factory, and will radiate our wires all over the business portion of the town. I want to get a 200 arc light machine, and also a strong dynamo for incandescent lights. We are certain the light is the best of all for domestic illumination, and have assurances that all of the first plant will be utilized. It pays. The *Register* plant runs 74 lights at a cost of about $85 a month, half of which is for attendance. The same attendance would run 200 lights, and the only extras would be increased interest on investment and repairs and fuel. I don't know how many incandescent lights we will run, but can place 300 or 400 at the start. The whole city ought to be illuminated with these lights, and do you know what it will cost? The experiments made on a large scale at big factories at the North show that the illumination is brighter than gas and costs the same as if gas were delivered at 56 cents per thousand feet. That's enough difference to make an impression upon the public, I should think."

MISCELLANEOUS NOTES.

ST. LOUIS ELECTRIC ELEVATED.—St. Louis is to have an elevated railroad, after all. The first defeat of the bill in the City Council was caused only by the absence of two members, so that the majority obtained was not a majority of the Council; but the next evening (4th inst.) the requisite vote was obtained, and the bill is now a law. A number of New York capitalists are concerned in this enterprise. The road will run from the business centre of the city to the western limits, with branches to the northern and southern suburbs.

STOCK QUOTATIONS.

Telegraph, telephone and electric light stocks were quoted as follows on Wednesday at the Electric, Manufacturing and Miscellaneous Stock Exchange, and at the Stock Exchange:

TELEGRAPH.—Am. Cable, b 51½.; American Rapid, b 50, a 65; B. & M. Co., b 30, a 40; Commercial Telegram Company Pref'd, a 109; Commercial Telegram Common, a 95; Harlem District Telegraph Co., b 2, a 2.50; Manhattan Telegraph, b 10, a 85; Mexican, b 125, a 147; W. U., b 58¾, a 58⅞.

The Western Union quarterly report is considered a favorable exhibit, but the low price of the stock is thought to indicate a want of public confidence in it. As this is Presidential campaign year, a good business is expected by all the companies between the present time and November.

Postal bonds have been stronger since the announcement of the new terms with the Bankers & Merchants' Co.

It transpires that A. W. Dimock & Co. held over 15,000 of the 22,000 shares of Bankers & Merchants' Telegraph stock, and kept the price above par to benefit their loans.

TELEPHONE.—American Bell, b 163, a 167; American Speaking, b 110, a 125; Currier Telephone Bell, b 3; Colombia and Panama, b 24.50, a 25; Continental, b 15; Dolbear, b 5, a 10; Hudson River, b 60, a 100; Inter-Continental, a 2.50; Mexican Central, a 3; Missouri & Kansas, a 10; Molecular, a 15; New England, a 80; New York, a 85; New York and New Jersey, a 70; New York and Pennsylvania, b 50, a 75; New York State Overland, b 15, a 20; Overland, b 7, a 12; People's, b 9, a 11; People's (N. E.), b 1, a 10.50; Solenoid, a 90; Southern Bell, b 95, a 125; Southern New England, a 175; Tropical, b 1, a 3; West India Telegraph and Telephone, b 1, a 1.25.

A noticeable feature of the week has been the strength of Bell telephone. Arguments on the completed evidence in the Drawbaugh suit are likely to be made next month.

The Boston *Advertiser* of June 11 says: In telephone stocks New England declined from 22 yesterday to 21; Erie, ½ to 23½; Mexican sold at 1⅛, and Tropical at 1⅛. Bell closed at 162 bid, 164 asked—no sales.

ELECTRIC LIGHT.—American, b 2, a 4; Baxter, b 23, a 25; Brush, b 50, a 80; Brush Illuminating, b 45, a 70; Daft, a 90; Edison, b 50, a 100; Edison Illuminating, b 55, a 75; Edison Isolated, a 90; Edison European, b 8, a 15; Excelsior, b 20; Swan Incandescent, b 15, a 40; United States, b 75, a 95; United States Ill. Co., a 90; United Globe Electric Light Co., b 55, a 65.

Kohlsaat & Co., No. 30 Pine street, furnish the following quotations for miscellaneous securities:

	About.		About.
Amer. Elec. Light	9	U. S. Electric Light	105
Brush Electric	75	Am. Bell Telephone	165
" " Illum	70	Mexican Telephone	20
Daft Elect L	65	N. J. & N. Y. Telephone	56
Edison Electric	105		

BUSINESS NOTICES.

ELECTRO-MEDICAL APPARATUS.—In answer to inquiries relative to their electro-medical machines, we unhesitatingly recommend the Jerome Kidder Co's apparatus. It is carefully made on correct principles, and adopted with various fittings for all the kinds of medication which modern science has pointed out, as finding a palliative or remedial agent in the electric current.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

Edited by N. S. KEITH, Electrical Engineer and Expert, 9 Murray Street, New York.

PATENTS DATED MAY 27, 1884.

Call Box for District Telegraphs; Michael J. O'Sullivan, of Baltimore, Md., Assignor of three-fourths to J. Frank Morrison, of the same place..... 299,417
Provides means for maintaining a ground connection when sending signals for protection against lightning.

Combined Curbstone and Telegraph Wire Conduit; James S. Woodward, of Philadelphia, Pa. 299,449
Properly-shaped, channeled iron-castings are used as a continuous curb to the sidewalk. The wires are laid, or supported, in the channel, which is covered by hinged covers.

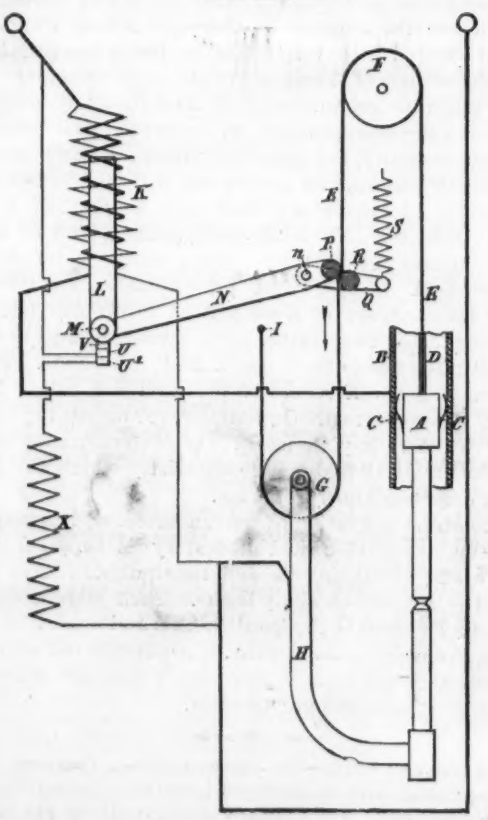
Construction of Electric Machines; Philip Diehl, of Elizabeth, N. J..... 299,117
For the purpose of adjusting the tension of the belt by which an electric generator is run, one end of the generator is pivoted between two standards, hangers, or brackets, the pivoting shaft being parallel with the shaft of the armature. The other end is supported by an adjusting screw, by means of which the height of that end, and consequently of the armature shaft, is determined.

Electro-Circuit Connection: David E. Drake, of Newark, N. J., assignor to The United States Electric Lighting Co., of New York..... 299,467
A plug-circuit maker for use in electric incandescence lighting.

Holder for Telephone Receivers; John N. Stewart, of Cleveland, O..... 299,288
Consists in the arrangement of two receivers, one to be applied to each ear of the operator, to be used at the same time. The receivers are mounted on the longer limbs of spring-forceps.

Insulating Pipe-Union; Charles Deaves, of New York, N. Y., assignor to the Archer & Pancoast M'f'g Co., of same place..... 299,206
Insulating material is properly placed between the parts of a pipe union, for use in insulating gas-fixtures and pipes when used to support electric incandescence lamps.

Secondary Battery; William Stanley, Jr., of Englewood, N. J..... 299,178
An electrode or element for secondary batteries, consisting, primarily, of tubes or hollow scraps of lead pressed together to form a plate.



Electric-Arc Lamp; Edward Jones and Albert Edward Jones, of Church Terrace, Queens Road, Battersea, Surrey, England..... 299,897

The action of the several parts is as follows: When the current passes, assuming the carbons to be touching, the main coil of the solenoid *K* will be powerfully excited, and will draw in the core *L*, which, in this arrangement, is attached to the long arm of the rocking lever *N*, thereby depressing the short arm and causing its finger or projection *P* to nip the band or cord *E* against the finger or projection *R* of the smaller lever or yielding bearing with an elastic grip, the intensity of which can be regulated by adjusting the tension of the spiral spring *S*. The further movement of the lever *N* toward the solenoid will still further depress the short arm of the lever against the yielding bearing *Q*, and will give a downward pull to the band or cord *E*. The effect of this will be to slightly raise one carbon and lower the other, thereby striking the arc. As the arc lengthens, the main solenoid current will diminish in intensity and that in the branch circuit will increase, the core will be gradually released, and the short arm of the lever will be lifted. The first effect of this gradual relaxation of pressure will be that the yielding bearing or spring-supported lever *Q* will rise and allow the band or cord to rise also and straighten itself out, and subsequently the pressure will be so slight that the band or cord will be free to slip over or between the smooth surfaces on the main lever and the yielding bearing or smaller lever *Q*, respectively, and allows the two carbons to approach simultaneously and restore the arc to its normal size.

Secondary Electric Battery; Eli T. Starr, of Philadelphia, Pa., Assignor, by direct and mesne assignments, to The Starr Electric Storage Company of N. J..... 299,434
Collects the gases given off, for subsequent use, or to pass out of the room. Feeds the cells with the battery liquid. Equalizes the fluid in the several cells. Automatic in the operations.

Secondary Battery; William Stanley, Jr., of Englewood, N. J..... 299,177
A plate or electrode for a secondary battery, consisting, primarily, of a mixture of carbonate of lead and chloride of sodium, ardened and atta ched to a suitable frame or support.

Telephone Support; Nathaniel C. Worth, of Canton, O..... 299,300
Consists in ear-pieces and a mouth-piece attached to an adjustable frame, and connected with each other and with the receiving and transmitting telephones by flexible tubes, to enable a central-office operator to listen and converse while the hands are left free to manipulate the switch board.